

Poland

Country Profile

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1. Overview of Electricity Supply

The business environment in Poland is generally good. The Polish power generation system is the largest in Central and Eastern Europe in terms of capacity. The power system is very fragmented, with nearly 400 power plants. Electricity generation is carried out by the state-owned Polish Power Grid Company SA (PSE) and a number of independent power producers (IPPs), which are partly owned by private companies. Over 97 percent of power generation is coal-fired, but there is potential for energy from renewable sources, particularly biomass and geothermal energy. Transmission is also controlled by PSE. The Polish power sector is set for gradual deregulation in line with European Union directives.

Industry-based power generation for internal use in Poland accounts for about eight billion kWh annually, of which more than six billion kWh is produced from combined-heat-and-power (CHP) cogeneration. Nearly 16 billion kWh is generated annually from district heating CHP plants. Overall, more than 15 percent of Poland's total electricity generation is generated in conjunction with heat.

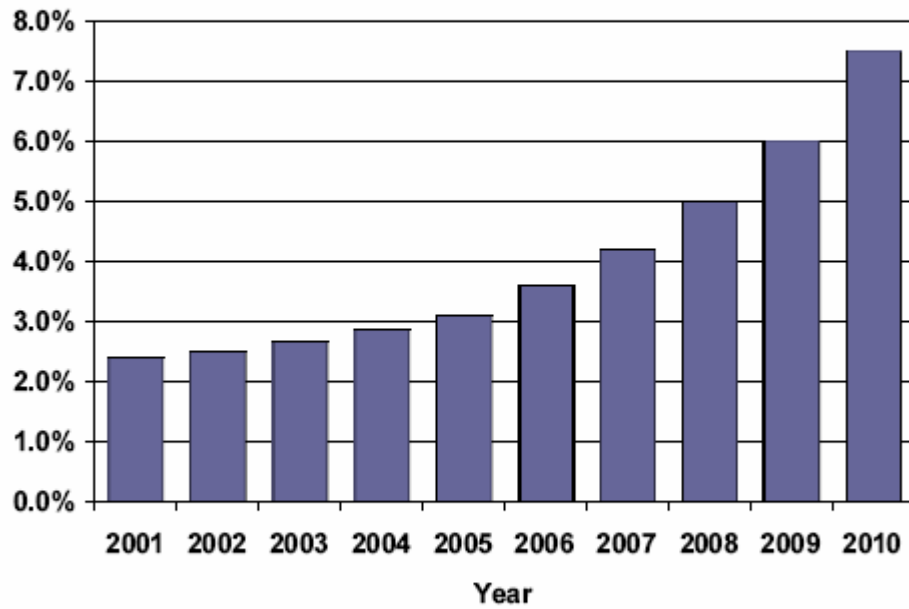
Poland's generating capacity is aging. Much of the current equipment was installed in the 1970s, and modernization efforts are required to maintain capacity and efficiency.

Additionally, there are plans to expand the existing transmission and distribution networks. These investments in the electricity industry are estimated to cost around \$50 billion over the next 15 years. Much of this cost, though, is proposed to be covered in the process of privatization.

Poland
Country Summary Table

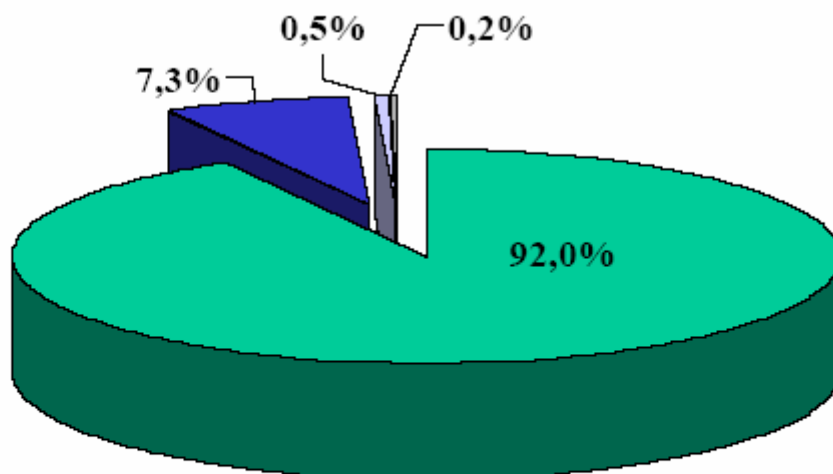
Demographical Information	
Population, millions (2003)	38.3
Land area, thousand Ha (2002)	31,269
Macroeconomic Information (2003)	
GDP, billion US\$	209.5
Real GDP growth rate, percent	3.70
Foreign direct investment (net), million US\$	3,950
Electricity sector	
Electricity tariff, US¢/kWh (2002)	8.8
Collection rate, percent (2002)	90
Load utilization factor, percent (2000)	NA
Current Feed-In (Euro)	0.029
Renewable Target (2010)	7.5%
Electricity disposition, billion kWh (2003)	
Generation	141.25
Consumption	121.26
Exports	15.10
Imports	5.00
Generation capacity, million kWh (2003)	
Nuclear	0.0
Thermal	28.4
Hydro	0.9
Other renewables	0.0
Total	29.3
<i>Sources: European Bank for Reconstruction and Development, U.S. Energy Information Administration, Food and Agriculture Organization of the United Nations.</i>	

Overview of Polish renewable electricity share increases



Source: The Polish Green Energy Outlook

Use of Renewable Energy Sources in 2002



■ Biomass
 ■ Hydro
 ■ Geothermal
 ■ Wind

Source: EC BREC data for the Polish Statistical Office, 2002

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2. Energy Policy, Barriers and Incentives

The Development Strategy of Renewable Energy Sector was adopted by the Parliament of the Republic of Poland in August 2001.

The strategic objective is the increase the share of energy from renewable sources in Poland's primary energy balance to 7.5 percent in 2010 and to 14 percent in 2020.

The Minister of Economy may, in the way of an ordinance impose on the energy enterprises dealing with trade of electric energy and heat, the obligation to purchase electric energy and heat produced by unconventional sources including renewable sources, and determine the detailed scope of this obligation.

Recently, new regulations from the Ministry of Economy oblige power utilities and energy turnover companies to buy energy from renewable sources. This year the limit is set at 2.5 percent of total produced and sold energy. To catch up with the European Union standards Poland needs to install more than 1,000MW.

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3. Wind

Due to excellent wind conditions and legal regulations, Poland is one of the most promising wind energy markets in Europe. The country possesses plenty of potentially profitable locations and great development possibilities.

Much of Poland has favorable conditions for wind energy production. The average wind speed in Poland varies between 5.5 and 7.0 m/s at a height of 50 meters. Assessed productivity of one 2MW machine may be equal to as much as 5.000 MWh per year.

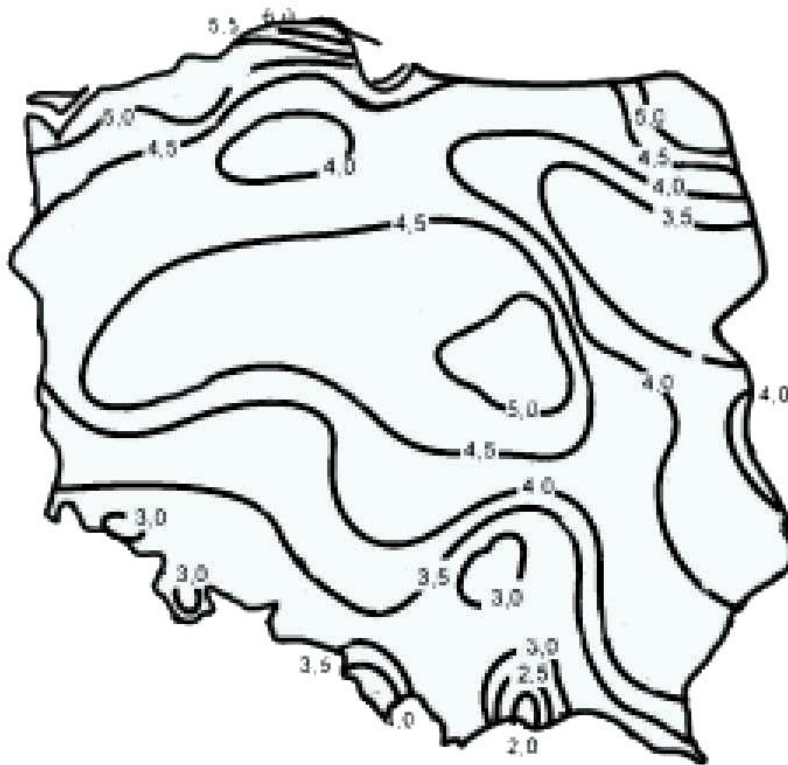
A country wide wind-atlas is available. According to this atlas there is one area in the northwest with wind speeds above 6 m/s at 10m. The Baltic coast, one large central area and an area to the north show wind speeds of 5 m/s.

There is an industry association and two local companies which manufacture Polish wind turbines. These are a 160 kW unit developed in 1993, and produced at the NOWOMAG Factory and the new approach of the KOMAG center aiming at a development of the prototype of state of the art wind turbine of 1MW according to the original technical concept, which is a compromise between present multi-gear and gearless solutions in wind turbines.

Poland has a good technical potential for wind energy development and local manufacturing. There is currently 108 MW of wind energy capacity in Poland.

The best sites are in the southern mountainous region and along the Baltic coast. The wind resources range from more than 1,000 kW/m²/year near the Baltic coast to less than 400 kW/m²/year in the center of the country. In the mountain range some sites are said to have high average wind velocities (10 m/s) due to local conditions.

Recently, the Risoe National Laboratory from Denmark widened the geographical scope of wind estimates in the European Wind Atlas to now include Poland. Risoe's estimates indicate that wind conditions along the Pomeranian Coastline are similar to those in Denmark and the Netherlands. In Central Poland, wind resources are very similar to those found in Germany.



Wind Atlas of Poland

Poland Areas/Projects with High Potential for Wind Energy

Project Name and Location	Description
Gulf of Gdasnk; Sulwaki	Baltic coast; Near Lithuanian border
Poznan, Wielkopolskie	West part of the country
Ciechanow, Mazowieckie	Center of the country
Silesian and Zywiec Beskids, Bieszczady and Dynowskie Plateaus.	

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4. Biomass

Biomass is the most promising source of renewable energy in Poland. The technical potential of biomass amount to 755 PJ/year, and the greatest opportunities for biomass technology implementation has been recognized in forestry, wood processing and agriculture sectors.

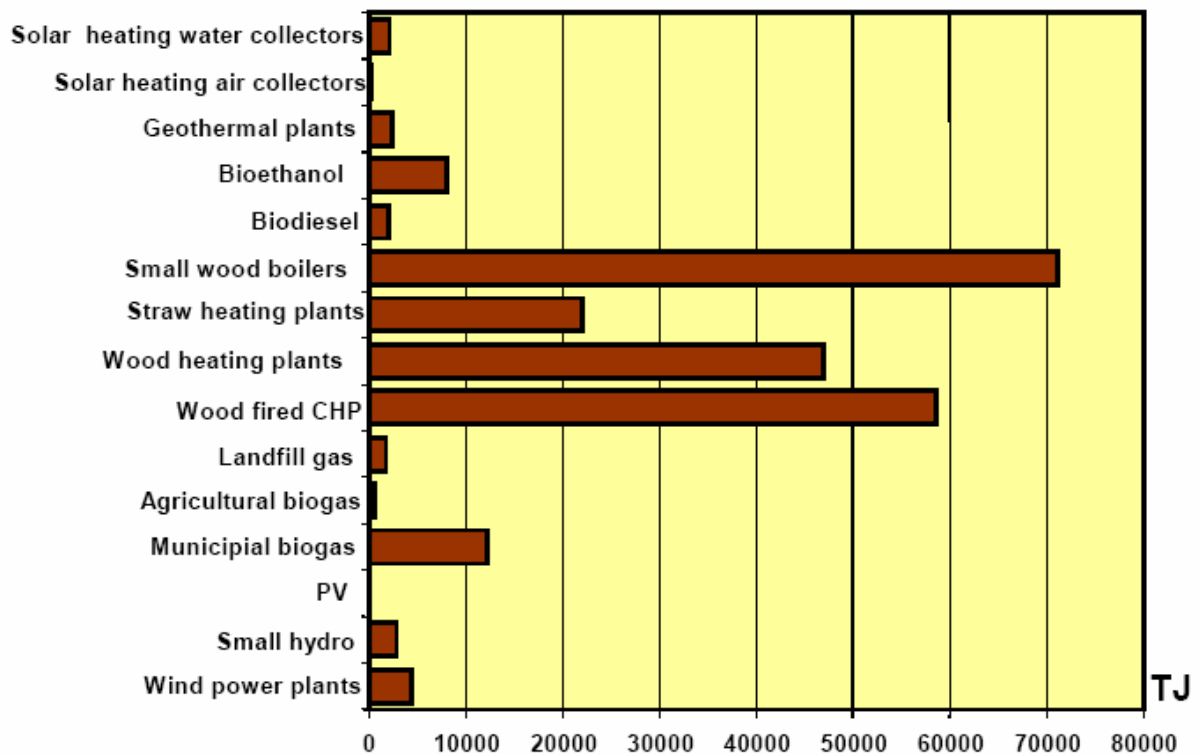
The majority of current biomass use is as heat for and small and medium scale boilers in industrial settings. Common fuel is wood pieces, sawdust, and wood shavings. Combined heat and power (CHP) plants using organic waste from pulp and paper operations, and straw and wood fired heating plants are also in operation.

Biogas production from landfill gas and municipal waste is also available. In 2002 there were about 25 landfill gas installations producing 22.3 GWh of electricity and 100 TJ of heat. Biogas production from municipal waste resulted in about 38 GWh of electricity and 450 TJ of heat.

About 47 percent of the land area of Poland, about 14 million ha, consists of arable and agricultural lands. Nearly 9 million ha is forested, about 28 percent. It is estimated that the total forest cover in Poland will reach 32 percent in the next 15 years.

The area with the most development in recent years has been energy generation from fuel wood, forestry residues, agricultural residues and surpluses. These have taken the form of individual and industrial heating plants, district heating and even CHP plants, in where biomass is replacing or reducing the use of coal. Considering the age and the decreased efficiency of many of the existing plants due to age or lack of maintenance, rehabilitation and conversion to a biomass boiler may be a possible alternative.

INCREASE OF RENEWABLE ENERGY PRODUCTION UP TO 2010



Source: International Energy Agency

Another alternative is the expanded use of biogas. Energy production projects from biogas generated from wastewater treatment plants, agricultural and livestock activities and landfills are currently being implemented.

In addition, biofuels is an area that appears to be developing, especially for the agriculture community. It has been a political priority of the Polish government to develop the use of biofuels. Biofuel has recently been utilized in conjunction with #2 fuel oil, for heating purposes. A 1997 biofuels law provides tax incentives for the use of #2 fuel oil / bio-fuel mixtures. In 2001, approximately 209 tons of bio-fuel was utilized for heating (Gierulski K., 2002a).

Poland Biomass Resource Data

Biomass resource type	Total production	Production density
Percent of total land area covered by		
Forests	8%	
Shrublands, savanna, and grasslands	0%	
Cropland and crop/natural vegetation mosaic	90%	
Urban and built-up areas	1%	
Sparse or barren vegetation; snow and ice	0%	
Wetlands and water bodies	2%	
Primary crop production, tonne	(avg. 1999-2001, tonne)	(tonne /1000 Ha)
Total primary crops (rank among COO)	83,836,385 (3)	2,754 (6)
Top 10 primary crops		
Potatoes	21,520,127	707
Sugar Beets	12,899,332	424
Wheat	8,982,393	295
Maize for Forage & Silage	6,333,333	208
Vegetables and Roots, Fodder	5,193,333	171
Rye	4,701,436	154
Mixed Grain	3,689,795	121
Barley	3,174,738	104
Leguminous (misc), Forage & Silage	3,064,000	101
Triticale	2,243,369	74
Animal units, number	(number)	(number / 1000 Ha)
Cattle	6,273,900	206
Poultry	49,772,000	1,635
Pigs	18,380,802	604
Equivalent animal units	14,123,941	464
Annual roundwood production	(1996-98, 000 m ³)	(m ³ / Ha)
Total	21772	715.2
Fuel	1492	49.0
Industrial	20280	666.2
Wood-based panels	3024	99.3
	(1996-98, 000 metric tons)	(metric tons / Ha)
Paper and paperboard	1828	60.0
Recovered paper	703	23.1



Territorial distribution of straw available for energy production in different provinces

Potential use of generated biogas are also high, with approximately 1,500 municipal wastewater treatment plants, the use of biogas generated from anaerobic processes for creating a self-sufficient treatment plant is a feasible option. However, expanded use of biogas generated from treatment plants into heat or electricity that can be sold for commercial purposes does not appear to be possible.

One last area that deserves mentioning is landfill biogas projects, with over 720 organized landfills, of which approximately 70-100 sites have extractable methane (CH₄) in concentrations greater than 240 million m³, the potential for energy use is very good.

There are very good opportunities for biomass development in Poland. The areas with the most potential for biomass / biogas projects are those in the northern and western regions, rural and mountainous regions, as well as the eastern border of Belarus.

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5. Solar

Solar radiation intensity in Poland heavily favors the spring and summer months, with around 80 percent of the annual insolation falling during this period. There is virtually no installed solar photovoltaic capacity.

Some liquid and air solar heat collectors are used in Poland. Air units are primarily used for grain drying, while liquid units are generally employed for space and hot water heating in homes and other buildings.

One potential of solar energy in the country is estimated as 370 PJ/yr. The technical potential for solar energy according to the EC BREC's studies of the year 2000 gives an annual technical

potential energy as 1340 PJ/yr. This number varies greatly in different studies. It is obvious that a country wide extensive research on the technical and economical feasibility of solar energy is needed.

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6. *Geothermal*

Poland has a sizable reserve of geothermal energy that is rich in low enthalpy resources, although there is little in the form of naturally occurring thermal springs or outflows. The country is characterized by large-scale low enthalpy resources which are contained in 3 sedimentary provinces which cover approximately 80 percent of the total land area. Currently the country utilizes the resources mainly for space heating and therapeutic purposes, although there are experimental projects regarding fish farming, timber-drying and greenhouse heating. Current installed capacity is approximately 69 MWt, of which 26 MWt is from heat pumps, which collectively generate 274 TJ of energy on an annual basis.

It was only recently that attempts have been made at exploiting the potential of the country's thermal resources. There are currently 3 sites that have been developed and are in commercial operation, providing mainly space heating for local residents as well as some experimental activities (i.e. fish farming, greenhouse heating, timber drying). The Podhale project was the first in development and in 2000 secured financing from the European Union and World Bank for further expansion of the plant to include district heating capabilities for nearby towns. The second project is located in Pырzyce and provides district heating for approximately 14,000 residents. Finally the third project is the Mszczonow, which is the most recent and most advanced of the three. The site provides district heating and drinking water for approximately 6,000 residents. It should be noted that all of the above projects required the additional installations of natural gas boilers to supplement the systems with additional heat capacity during the colder months.

Additionally, there are several heat pumps installed in many areas of Poland such as Sudetes, Kielce, as well as in the Polish Lowlands, where several individual villas and residences utilize the resources.

The Polish Geothermal Association (PGA) has been pushing for an increase in the use and awareness of the country's resources. While Poland has set aggressive goals concerning renewable energy to be met in 2010 and 2020 respectively, it is viewed that the majority of the renewable energy development will be in biomass.



Source: Polish Geothermal Association

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7. Hydroelectric

Hydro power will probably remain the second largest renewable energy source with limited possibilities of further growth. The Polish hydro power resource is small due to the limited and unfavorable distributed rainfall, high soil permeability and relative flatness of the country. The total installed capacity of large hydro-electric power stations is around 340 MW and 185 MW of small hydro.

The total technical potential of hydro energy is equal to 49 PJ/year, of that, 6 PJ/year is from small hydro. As for the small hydro plants, about 1,000 plants could be built with a total capacity of 200 MW and estimated electric energy production 1,000 GWH/year. Due to limited water resources in Poland, the installed power of a most of the small hydro plants is below 100 kW. Such power stations offer a chance of improving the very poor runoff coefficient, particularly on small rivers. What is also important is the local retention of water. Small hydro takes advantage of the local possibilities of electricity generation thus providing a source of income to a group of people, usually in areas with a high unemployment rate.

The power output of existing hydro-electric power stations may be increased by 20-30 percent through modernization of the generators.

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8. Relevant Links

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10. Country Contacts

Contacts made in the preparation of this assessment are gratefully thanked for their contribution to this report. Contacts include: